State of Illinois, Department
of Registration and Education
STATE GEOLOGICAL SURVEY, URBANA

JOHN C. FRYE, Chief

EARTH SCIENCE FIELD TRIP
GUIDE LEAFLET
MARSEILLES-OTTAWA AREA

LASALLE COUNTY
MARSEILLES AND OTTAWA QUADRANGLES

Leader

GEORGE M. WILSON

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA

September 15, 1956

GUIDE LEAFLET NO. 56D HOST: MARSEILLES HIGH SCHOOL

MARSEILLES FIELD TRIP

September 15, 1956

Dis-tance	Mile-age	
0.0	0.0	Cars face north in front of Marseilles High School.
0.6	0.6	Cars turn left and proceed to Stop Street - turn right.
0.2	0.8	Proceed north on Main to stop light - proceed ahead.
0.0	0.8	Sandstone on left is the Vermillionville sandstone (Pennsylvanian) of northern Illinois, called the Cuba sandstone in western Illinois, and the Absher in southern Illinois. This sandstone overlies the No. 5 coal which is extensively mined in western and southern Illinois. In this area we find no No. 5 coal, only the underclay and the overlying black shale.

The Vermillionville sandstone is a channel-fill type of sand, and at many places the lower portion of the channel contains a conglomerate that contains large and irregular shale fragments similar to the shale in the walls of the channel. As we climb the hill and reach the upland we are on morainic topography - the Marseilles moraine.

Discussion of Glaciation - see pages 8 and 11.

The glacial deposits that we will observe today were deposited during the last two stages of glaciation - the Illinoian and Wisconsin. There are two older stages of glaciation - the Kansan and Nebraskan. The oldest is the Nebraskan. The moraine that we are passing over is called the Marseilles. It is one of the largest and highest of the moraines in Illinois. In this area it has a width of more than four miles and is easily 100 to 160 feet above the lake plains which surround it. The moraine is crossed by two deep channels that served as outlets for glacial Lake Wauponsee.

2.8	3.6	As we cross a portion of the moraine we drop into an old sub-glacial channel, as we turn left note how thick the black soil is on the yellow sub-soil.
0.9	4.5	<u>STOP 1</u>. Soil Profile. Discussion of the development of soil.

The soil that we see here is derived from the weathering of glacial materials, whether loess, silt, or glacial drift. The soil in this area averages 3-4 feet in thickness, but here it is only a few inches thick.

Like many other things, rocks and minerals suffer changes when they are exposed to the weather. Although these changes are relatively slow, they become evident in earth deposits that are not disturbed over long periods of time and develop what is known as a weathering or soil profile in the surficial part of such deposits.

Following the practice established about 30 years ago by the Russian Glinka, soil scientists usually consider that the soil or weathering profile consists of 3 zones, designated A, B, and C from top down. The A zone is the "soil" zone, which is normally black or gray in color. The B zone is the "subsoil" zone, and the C zone is the unaltered parent material.

The zonal effect results from the fact that the four principal processes which effect soil weathering all progress with the downward movement of groundwater but at different rates. These processes, listed in order according to their rate of progress, beginning with the most rapid, are (1) oxidation, (2) leaching of carbonates, (3) decomposition of more resistant minerals, and (4) accumulation of humus.

Consequently, in the A zone, in which the humus material derived from decaying plants has accumulated, the rock minerals are oxidized, leached, and decomposed. In the upper part of the B zone they are oxidized and leached and in the lower part of the B zone they are only oxidized. The oxidation zone is shown by the reddish or yellowish color resulting from the oxidation of iron minerals. The leached zone is determined by the absence of carbonates, as revealed by tests with a solution of hydrochloric acid.

Lying ahead of us (west) and beginning at an elevation of approximately 640 feet we find evidence of the highest stage of glacial Lake Ottawa. The lake plains were formed during the culmination of the Valparaiso stage, at the time of the Kankakee Torrent, when the waters were ponded behind the Cropsey, Farm Ridge, and Marweilles moraines. At this time the Kankakee, DuPage, and Des Plaines rivers were receiving the meltwaters from the ice in Michigan, Indiana, and northeastern Illinois. The streams overflowed onto the flat upland between the moraines where they dropped their load of silts and clay, and deposited some gravel in channels.

The glacial lakes thus formed in this area at the time of the Kankakee Torrent were Lake Ottawa in front of the Marseilles moraine, Lake Wauponsee behind the Marseilles moraine, Lake Pontiac to the southwest of the Marseilles moraine and Lake Watseka on the south of Marseilles moraine. As the volume of water decreased, the waters were confined to the river valleys which continued to erode actively although it was receiving deposits of sand and gravel. The lowest erosional level of the Kankakee Torrent is called the Buffalo Rock terrace at an elevation of about 540 feet.

0.5	5.0	At this point one can see the gentle slope of the front of the Marseilles Moraine and look out across the old Lake Ottawa Plain.
2.9	7.9	Proceed to Stop sign - turn right.
3.6	11.5	Along this road we are travelling on the shoreline of old Lake Ottawa. Slow, caution, turn left.
2.6	14.1	Follow winding gravel road - slow.
0.1	14.2	Cross Fox River turn right and stop - Wedron Silica Company.
1.0	15.2	STOP 2. Trip through the silica sand quarry of the Wedron Silica Company. Caution Railroad Crossing!!!

This sand quarry is of especial interest because of the wealth of interesting material that has been found here. The operation here is in the St. Peter sandstone which is exposed by stripping away the overburden of glacial drift. The following page is a detail of the west face of the overburden, showing the many variations of the glacial deposits in this area.

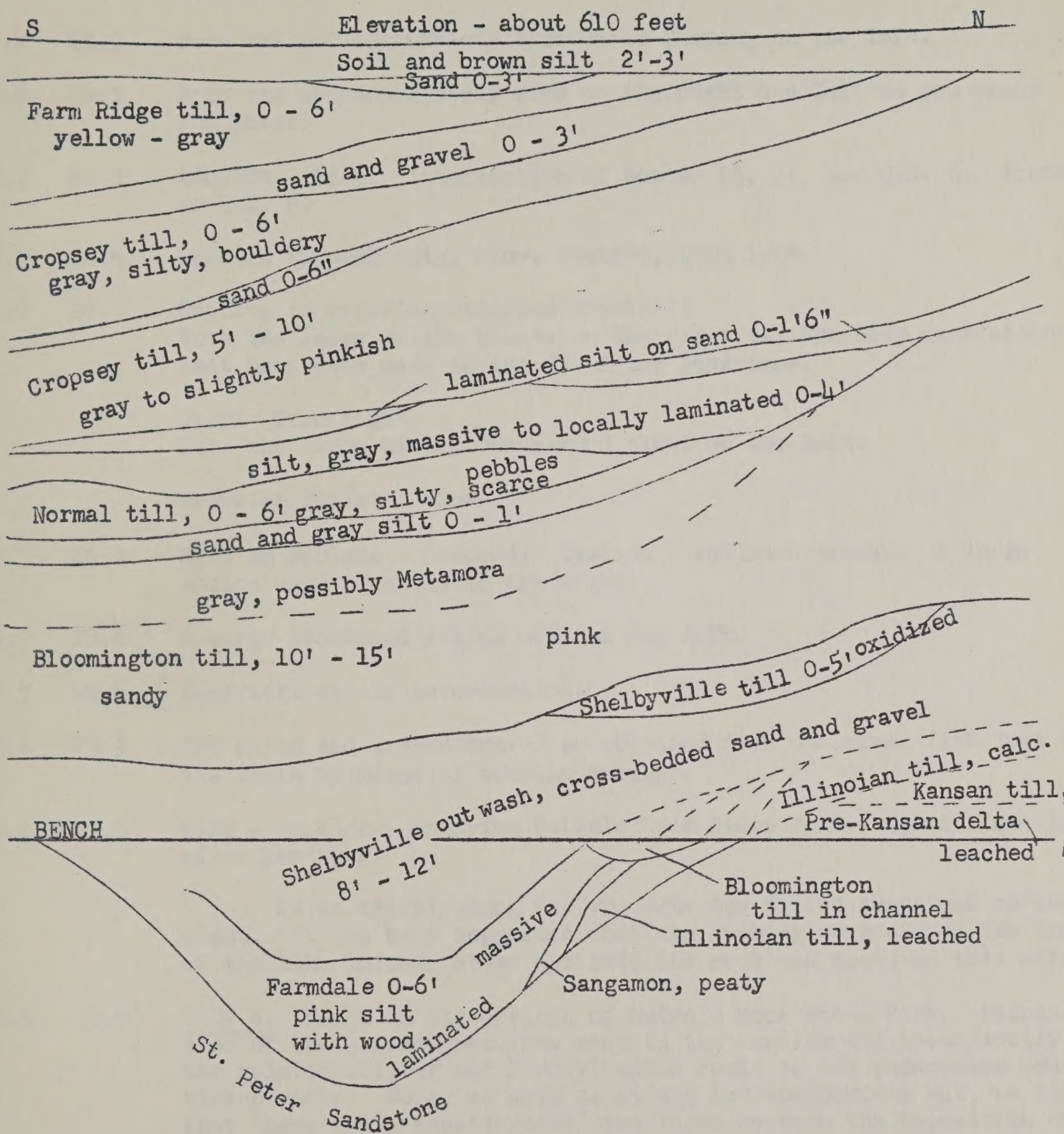
The St. Peter sandstone here is quarried, broken down, pumped to the mill, where the sand is washed, sized, dried and sacked for various uses. The deep channel in the sandstone is a pre-Wisconsin-Sangamon channel. See page 3A.

0.1	15.3	Cross Fox River.
2.6	17.9	Follow winding gravel road and return to Route 71 - Stop.
4.2	22.1	Turn right entering Route 71 - at elevation 570 we enter the level of the Buffalo Rock Terrace.
0.8	22.9	STOP 3. Clay pit of the LaClede-Christy Firebrick Company. CAUTION: Be careful in crossing Route 71.

Here we see a stripping operation in which the glacial drift, shale, and coal are removed in order to reach the underclay which is refractory and is used in the manufacture of refractory brick. This brick resists high heat without deformation or melting. The coal is also recovered and used locally.

The section here is as follows:	Thickness Ft.	In.
Pleistocene - Wisconsin		
Soils	2	0
Glacial drift	3	0
Pennsylvanian		
Liverpool cyclothem		
Francis Creek - gray, well laminated	15	0
Coal No. 2	1	7
Underclay - fireclay, kaolinitic	6-7	

Wedron Silica Company, Wedron, Illinois



About 100 yards horizontally

Vertical scale - 1" = 10'

The above clay is here the base of the Pennsylvanian St. Peter sandstone - Ordovician system.

0.1 23.0 Return to cars. Caution, junction with Route 6, continue ahead on Route 6.

0.9 23.9 Note the LaClede-Christy Fire Brick Company on the left.

0.6 24.5 Note the abandoned strip pits on the right and left as you cross Fox River.

0.7 25.2 CAUTION. Stop. Intersection of Routes 23, 71, and U.S. 6. Proceed on U.S. 6.

1.2 26.4 Proceed through city, Slow, caution, turn left.

1.0 27.4 Caution in crossing railroad tracks!!!
Note the large silica plants on the right and the deep excavations that have been made in the St. Peter sandstone.

Stop. Turn right.
Note the large Libbey-Owens-Ford plant on the left.

Entering Naplate, slow.

0.7 28.1 Stop in Naplate. Proceed. Caution - railraod tracks. A large silica sand plant is on the right.

0.7 28.8 A large abandoned silica mill on the left.

0.7 29.5 Bear left at the intersection.

0.4 29.9 The sized and graded gravel is obtained from the river flat just to the south by means of suction dredges.

0.1 30.0 Slow - caution - entering Buffalo Rock State Park. Speed limit 10 miles per hour.

As we travel along the way note the fluted sandstone on the right. It has been suggested that the rushing currents at the time of the lake Chicago stage cut into the rock and produced this effect.

0.5 30.5 STOP 4. Lunch in the grounds of Buffalo Rock State Park. Discussion of the general problems seen in the morning and specifically the relationship of the Pennsylvanian rocks to the underlying Ordovician rocks. Here, as well as at the LaClede-Christy pit, we find that there was a considerable time lapse between the deposition of the Ordovician and Pennsylvanian.

In the bluff we see, beginning at the top of the section:

	Thickness Ft.	In.
Shale, gray, well laminated	20	
Coal No. 2	1	6
Underclay, brown, sandy		2
Sandstone, gray, carbonaceous, much reworked St. Peter sandstone.		
St. Peter sandstone, gray to yellow, buff, massive, crossbedded	100	

Here we have virtually no underclay between the coal and the underlying sandstone, but a clay pit was formerly operated only a few hundred yards away. As the rocks dip to the west the interval between No. 2 coal and the St. Peter widens.

0.5 31.0 Leave park - slow as we approach the exit. Turn left.

0.7 31.7 Note abandoned crude silica plant on left as well as abandoned coal and fireclay stripping operations on the right and left.

0.4 32.1 Caution - cross railroad track, turn left.

Entering crude silica sand pit in St. Peter sandstone. The St. Peter here varies from other sand only in that the sand has been stained from the weathering of the overlying sediments. Crude sand and foundry sand are produced from this pit. Of considerable interest to the geologist is the occasional clay pocket that occurs in the St. Peter sandstone. These clay pockets appear to be widened joints that developed during the long erosional interval. When the early Pennsylvanian rocks were deposited in this region, clay filled the open joints.

1.7 33.8 Follow pit road back to graveled highway, turn right, follow road. Slow - entrance to Buffalo Rock State Park.

0.5 34.3 Proceed ahead, caution, intersection from left.

0.5 34.8 STOP 6. Here we are at the edge of the terrace developed by the flood waters of glacial Lake Chicago. The level of the terrace coincides with the groove developed in the base of the cliff at Buffalo Rock. It was during this time that Buffalo Rock was isolated by this erosion.

You may notice that there is a fossiliferous limestone in the spoil on this terrace surface and one might postulate that this limestone which in part caps the terrace in this area may have been a controlling factor in preserving this terrace. After the development of glacial Lake Chicago had cut the terrace and the lake was slowly declining the Illinois River entrenched itself in its present channel.

0.4	35.2	Entering Naplate.
0.3	35.3	Stop. Proceed.
1.0	36.3	Turn left.
0.1	36.4	Turn right.
0.4	37.8	Stop. Proceed ahead.
0.1	37.9	Stop light. Turn right.
0.1	38.0	North side of bridge over Illinois River.
0.6	38.6	Cross bridge. Stop. Follow Route 23, turn right.
0.3	38.9	Follow street, turn left.
0.3	39.2	Follow street, turn right.
0.1	39.3	Turn left.
0.3	39.6	Turn right.
0.5	41.1	STOP 7. Gravel deposit in Lake Illinois, Farm Ridge sub-stage.

These deposits were to a large part over-ridden by the Marseilles deposits, but in the region south of Ottawa, lying beneath the Ottawa terrace are gravel deposits of Lake Illinois age. These deposits largely occur in steep sided channels in glacial drift or bedrock. You will note that in this deposit the gravel is cross-bedded in repeated sequences. The section is as follows:

	Thickness Ft.	Thickness In.
Pleistocene		
Humus, silty	1	
Silt, brown noncalcareous	2	
Tazewell sub-stage		
Farm Ridge drift, Lake Illinois Delta		
Gravel, fine, cross-bedded	10	
Silt, brownish-gray, calcareous	1-2	
Gravel, fine, poorly sorted, cross-bedded	10	

0.3	41.4	Caution, railroad crossing.
0.3	41.7	Stop. Caution. Turn left, entering Route 71.
0.8	42.5	Slow. Turn left leaving Route 71. Note the abandoned mines in the No. 2 coal on the left.

0.2 42.7 Slow. Cross Covel Creek, note the Ordovician-Platteville limestone in the banks of the creek.

0.3 43.0 Note the Cuba-Vermillionville sandstone on the right. This sandstone overlies the position of the No. 5 coal.

1.6 44.6 Turn left.

0.5 45.1 Turn right.

0.1 45.2 Turn left.

1.6 46.8 Turn left, we are on the Lake Ottawa plain.

1.0 47.8 Note the terrace level developed in Covel Creek.

0.1 47.9 STOP 8. St. David and Summum cyclothems.
The section here is as follows:

	Thickness Ft.	Thickness In.
Pennsylvanian		
St. David cycle		
Shale, well laminated	20	
Shale black, sheety, Position of coal 5A		5
Shale, gray, fine, thinly laminated, with many ironstone concretions		
Shale, dark, fine, carbonaceous, rather fossiliferous	1	
Shale, black, sheety, hard, with many impressions of Dunbarella (pectens) in lower 2 inches	1-2	
Shale, calcareous, very fossiliferous, pyritic		6
Shale, dark gray, fine, thinly laminated and weak, with an occasional, black, hard, calcareous concretion		8
Shale, medium gray, fine, thinly laminated	2	
Summum Cycle		
Cone-in-cone		1-2
Limestone, blue-gray, dense, hard, conglomeratic in lower part (Covel conglomerate - type section)		3-10
Underclay, medium-dark gray, medium coarse	4	
Limestone, medium gray, a coquina of small marine fossils, especially ostracodes and brachiopods with a conglomerate band in lower few inches	1	
Concretion band - tends to be nodular, hard, dense		0-10
Clay shale, fine, greenish-gray	2	
Black shale, coaly		1
Underclay, light gray		6

You will note that in neither of the cycles is the coal developed, yet only a few miles away the No. 5 coal is extensively mined as in the Peoria region.

0.8 48.7 Return to cars, follow road to intersection with Route 23. Turn left to go to Ottawa, turn right to go to Streator.

Adios! See you on October 6th at LaHarpe!

GLACIAL HISTORY

The Marseilles area has a wealth of Pleistocene geology to offer the field tripper. There are moraines, sub-glacial channels, kames, eskers, terraces, all within a relatively restricted area. These deposits have been studied and reported upon in Bulletin 66, "Geology and Mineral Resources of the Marseilles, Ottawa and Streator Quadrangles" by H. B. Willman and J. Norman Payne.

Long ago, perhaps as long ago as one million years or perhaps as recently as five thousand years ago, ice in the form of glaciers covered various portions of North America. These glaciers had various centers of accumulation, mostly in eastern Canada. As the ice and snow accumulated to great thicknesses they spread outward. Just why the glaciers accumulated is not known. The furtherest known advance of any of the glaciers of the Pleistocene or "Ice Age" was the Ohio and the Missouri rivers.

Moderation of temperatures halted the advance of the glacier. Then the melting of the ice equalled the accumulation and consequent expansion, so that the margin of the ice remained virtually stationary. When the melting exceeded the rate of expansion the ice front retreated until the glacier disappeared completely.

As the glacier melted, all of the soil and rocks that had been picked up as it advanced were released. Some of this material or drift was deposited in place as the ice melted. Such material is a thorough mixture of all kinds and sizes of rocks and is known as till. Some of the glacial drift was washed out with the melt waters. The coarser outwash material was deposited nearest the ice-front and finer material was deposited farther away. Where the outwash material was spread widely in front of the glacier it forms an outwash plain; where restricted to the river valleys it forms what are called valley-trains.

At times the outwash plains and valley-trains were exposed when the melt-waters subsided, then the wind picked up silt and fine sand from their surfaces, blew it across the country, and dropped it to form deposits of what is known as loess. Glacial loess mantles most of Illinois. Near the Mississippi and Ohio rivers, as well as along the lower Illinois River, as much as 80 feet of loess is known, whereas in areas away from the larger streams only a few inches of loess can be identified.

As has been stated, we recognize four major periods of glaciation during the Pleistocene (see following pages) and between each pair there was a long interglacial period in which it is thought that conditions were similar to those of today. With each major glaciation the ice advanced and retreated a number of times. This situation is especially apparent in the deposits left by the last or Wisconsin glacial stages.

The position of the ice-front at each advance of the glacier is usually marked by a ridge of till, called a moraine. The moraine represents the accumulation of drift at the ice margin when the advance and melting were essentially in balance, and more and more drift was being brought to the front of the advancing ice. When melting exceeded advance, so that the ice front retreated, the resulting drift deposits form a drift-plain or till-plain, whose surface may be almost level or more or less billowy.

The attached map shows the moraines of Wisconsin age in Illinois. The surface relief of moraines is generally greater than that of the drift plains. It is generally referred to as swell-and-swale, but on some moraines it is termed knob-and-kettle topography. Often the outer slope and edge of the moraines is interrupted by valleys and re-entrant angles that mark the courses of glacial rivers. At some places there are gaps in the moraines where sub-glacial streams presumably carried away most of the drift.

As a glacier began to recede, meltwater accumulated in local ponds between the ice front and the moraine last formed, except where there were channels through the moraine through which the pond could drain. Where such drainage channels are absent, it may be presumed that as the ice-front continued to recede, the local ponds gradually merged into one large lake that persisted until the retreating glacier uncovered some outlet, or until some river eroded a channel of sufficient depth to drain the pond.

GEOLOGICAL HISTORY OF THE MARSEILLES-OTTAWA AREA

Bedrock Formations

The bedrock exposed in the Marseilles-Ottawa area is of Ordovician and Pennsylvanian age. Below these strata lie a considerable thickness of lower Ordovician and Cambrian sediments composed of sandstone, dolomite, shale and limestone. Beneath these rocks we only occasionally have an opportunity to examine samples from the basement complex and we are unable to learn anything of consequence concerning the basement complex.

Let us turn our attention to the rocks of Paleozoic age and especially those in the immediate area. With the development of the LaSalle anticline, only a short distance to the west the rocks on the east and gentle flank were eroded away; that is to say those of upper Ordovician, Silurian, Devonian and Mississippian. The principal deformation along the LaSalle anticline and the area to the east occurred after the Mississippian time and during early Pennsylvanian, allowing the erosion and removal of approximately 1700 feet of limestone, sandstone and shale. Thus the first sediment received during the Pennsylvanian in this area was in the Liverpool Cycle.

In the areas east and west of this arch the Pennsylvanian rocks are deposited on rocks of upper Ordovician, Silurian, Devonian and Mississippian age which intervene between the Pennsylvanian above and the (St. Peter) lower Ordovician below.

After Pennsylvanian time there was again further deformation along the La-Salle axis.

Formation of Stratified Bedrock

In the Marseilles area the oldest exposed rocks are of Lower Ordovician called the St. Peter sandstone. It is thought that this remarkably pure sandstone is of marine origin, having been deposited in shallow seas. In the Minneapolis area this sandstone has an occasional marine fossil.

The overlying Platteville limestone fills channels that have been cut in the St. Peter surface.

For the most part, where the Pennsylvanian sediments are seen in contact with the Ordovician in this area, the first recognizable rocks are in the Liverpool cycle.

During the Pennsylvanian, the region was low lying and the sediments were deposited in rather shallow seas. It is logical to assume that under such an environment that there would be a rather wide range of sediments laterally as well as in vertical sequence. Many of the rocks are observed to be repeated in similar sequences.

While an ideally complete cycle of deposition is seldom demonstrated, the sequence, beginning at the base is as follows: (1) sandstone or siltstone, (2) sandy shale, (3) limestone, (4) underclay, (5) coal, (6) gray shale, (7) limestone, (8) black shale, (9) limestone, and (10) gray shale. (See attached sheet.)

OUTLINE OF THE PHYSIOGRAPHIC AND GLACIAL HISTORY of the MARSEILLES-OTTAWA AREA

by H. B. Willman

(Based largely on studies by M. M. Leighton, George E. Ekblaw, Leland Horberg, and H. B. Willman)

Pliocene Epoch	Development of the Central Illinois peneplain with a relatively flat surface across the La Salle anticline.
	Deposition of chert gravel in channels, as near Ottawa.
Pliocene and/or Pleistocene Epochs	Dissection of the peneplain leaving a north-south divide on the La Salle limestone on the west slope of the La Salle anticline. Drainage west from the divide to the Ancient Mississippi River which then was flowing east from the Rock Island region to the present course of Illinois Valley below the "big bend" at Bureau. Drainage east to a south-flowing river near Morris.
Pleistocene Epoch	
Nebraskan Glacial Stage	Invasion of western Illinois by an ice sheet from the Keewatin center. Weathering in the La Salle area.
Aftonian Interglacial Stage	Weathering in the La Salle area.
Kansan Glacial Stage	La Salle area covered by an ice sheet moving southwestward from the Labradorean center. Diversion of east-flowing streams westward across the La Salle anticline and erosion of Ticona Valley, a few miles south of the present Illinois Valley, to a depth of over 200 feet.
Yarmouth Interglacial Stage	Deep weathering and erosion of Kansas drift. Drainage along Ticona Valley, to the Ancient Mississippi Valley.
Illinoian Glacial Stage	La Salle area again covered by Labradorean ice and the earlier drift eroded except along the valleys. Major valleys not completely filled with drift so that on retreat of the ice, rivers were re-established in the Ancient Mississippi and Ticona Valleys.
Sangamon Interglacial Stage	Deep weathering of Illinoian drift. Local accumulation of peat and alluvium.
Wisconsin Glacial Stage	
Farmdale Substage	Deposition of loess probably from a valley-train along Ancient Mississippi Valley, followed by a short interval of weathering.

Iowan Substage	Valley-train along the Ancient Mississippi Valley from the Keewatin ice sheet which crossed Iowa to the Mississippi Valley. Deposition of loess in the La Salle area.
Tazewell Substage	Ice advanced from Labradorean center, crossed the La Salle area and deposited the Shelbyville moraine. Mississippi River diverted westward to the present channel. On retreat of the Shelbyville glacier, the Ancient Mississippi Valley was blocked at Peoria by the Shelbyville moraine forming Lake Kickapoo which extended up Ticona Valley into the La Salle area.
	Repeated readvance and retreat of the ice, building several moraines behind the Shelbyville moraine in east central Illinois, filling Ticona Valley, and leaving the lowest drainage channel at the present position of Illinois Valley.
	Readvance of the ice and deposition of the Bloomington-Normal moraines, again blocking drainage at Peoria and forming Lake Illinois at an elevation of 600 feet A.T.
	Building of deltas in Lake Illinois by melt-waters from the retreating ice-front.
	Repeated readvance and retreat of the ice-front depositing, consecutively, the Cropsey moraines west of La Salle and the Farm Ridge and Marseilles moraines east of La Salle. Deltas formed in Lake Illinois.
	Retreat of the ice front from the Marseilles moraine. Fox Valley Torrent eroded the dam of Lake Illinois at Peoria and drained the lake.
Cary Substage	Readvance of the ice and deposition of the Minooka, Rockdale, and Valparaiso moraines.
	The Kankakee Torrent, at the beginning of Valparaiso retreat, discharged a larger volume of water into Illinois Valley than the valley could carry, and the water spread widely over the uplands forming lakes between the moraines at a maximum elevation of about 650 feet. Upland surfaces were channeled and benches were eroded, especially where the waters were concentrated through the moraines, as north of Split Rock.
	Declining waters of the Kankakee Torrent eroded channels as low as 540 feet, the top of Buffalo Rock and Starved Rock.
	Readvance of the ice and deposition of the Tinley moraine behind the Valparaiso. On retreat of the ice-front, Lake Chicago was formed between the ice and the moraine. Outlet along Des Plaines and Illinois Valleys.
	Overflow from Lake Chicago (Outlet River) eroded Illinois Valley to the level of the Ottawa terrace, the rock bench which covers all the valley floor at Ottawa except the narrow channel occupied by Illinois River. Tributary valleys were left hanging, resulting in development of canyons, as in Starved Rock Park.

Mankato Substage

During the late stages of Lake Chicago channels were eroded in the Ottawa terrace and coarse gravel, consisting largely of Niagaran dolomite from the Chicago region, was left in the channels, as near Buffalo Rock.

Outlet River covered the valley from bluff to bluff and a small falls or cascade half a mile east of Buffalo Rock was retreating headward when the Chicago outlet was abandoned.

The declining waters of Lake Chicago eroded only a narrow channel in the Ottawa terrace east of Utica where the terrace is underlain by St. Peter sandstone and the Shakopee and Platteville dolomites. Farther west the relatively soft Pennsylvanian rocks were easily eroded and only remnants of the terrace remain. Recent alluvium covers the entire valley floor.

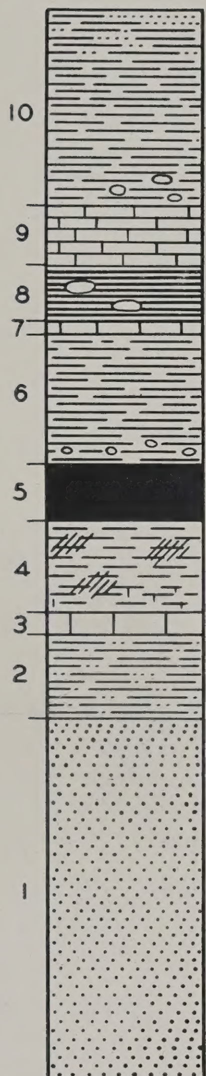
(For further details and references see Illinois Geological Survey Bulletin 66, pp. 140-180, 204-230.)

Time Table of Pleistocene Glaciation
(after M. M. Leighton and H. B. Willman, 1950)

Stages	Sub-stages	Nature of Deposits	Special Features
Recent		Soil, infant to youthful profile of weathering, lake and river deposits, dunes, peat.	
Wisconsin (4th glacial)	Mankato: Late, Early	Fluvial deposition - Mississippi, Illinois, and Ohio river valleys; dune sand, some loess deposits along Mississippi River Valley; and deposits in Lake Chicago	Lake Agassiz Torrent eroded Late Mankato deposits Lake Duluth Torrent eroded Early Mankato deposits Forest bed, Two Creeks, Wisconsin
	Cary	Drift, loess, dunes, beginning of deposits in Lake Chicago	Kankakee and Lake Maumee Torrents
	Tazewell	Drift, loess, dunes, lake deposits	Fox River Torrent Westward diversion of Mississippi River into Iowa by Tazewell ice lobe
	Iowan	Drift, loess, dunes	
	Farmdale (Pro-Wis.)	Loess (in advance of glaciation)	
Sangamon (3rd interglacial)		Soil, mature profile of weathering, alluvium, peat	
Illinoian (3rd glacial)	Buffalo Hart	Drift	
	Jacksonville	Drift	
	Payson (terminal)	Drift	
	Loveland (Pro-Ill.)	Loess (in advance of glaciation)	
Yarmouth (2nd interglacial)		Soil, mature profile of weathering, alluvium, peat.	
Kansan (2nd glacial)		Drift Loess	
Aftonian (1st interglacial)		Soil, mature profile of weathering, alluvium, peat	
Nebraskan (1st glacial)		Drift	

ROCKS TYPICALLY EXPOSED IN THE MARSEILLES-OTTAWA AREA

Era	System	Series	Group	Formation	Material
CENOZOIC	Pleistocene				Till, gravel, sand, silt, clay
	Tertiary				Conglomerate and sandstone
PALEOZOIC	Pennsylvanian		McLeansboro Carbondale Tradewater		Sandstone, shale, clay, limestone, coal
	Mississippian	Iowa	Kinderhook		Shale, brown
	Devonian				Limestone, light gray
	Silurian	Niagaran		Port Byron Racine Waukesha Joliet	Dolomite and (or) some limestone
		Alexandrian		Kankakee Edgewood	Dolomite and sandstone
	Ordovician	Cincinnatian		Maquoketa	Shale and some dolomite or limestone
		Mohawkian		Galena Decorah Platteville Glenwood	Dolomite and (or) limestone, light brown Dolomite and (or) limestone with streaks of shale Dolomite and (or) limestone Sandstone, shale, and dolomite
		Chazyan		St. Peter	Sandstone, sometimes conglomeratic at base
		Prairie du Chien		Shakopee New Richmond Oneota	Dolomite with some thin sandstone beds Sandstone and some dolomite Dolomite, usually cherty
	Cambrian	St. Croixan		Jordan Trempealeau Franconia	Dolomite, sandstone, and shale Dolomite Sandstone, dolomite, and shale; very glauconitic
			Dresbach	Galesville Eau Claire Mt. Simon	Sandstone with some dolomite Sandstone, shale, and dolomite Sandstone, arkosic in lower part; some shale and conglomerate
Pre-Cambrian					Crystalline rocks



Shale, gray, sandy at top; contains marine fossils and ironstone concretions especially in lower part.

Limestone; contains marine fossils.

Shale, black, hard, laminated; contains large spheroidal concretions ("Niggerheads") and marine fossils.

Limestone; contains marine fossils.

Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

Coal; locally contains clay or shale partings.

Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

Shale, gray, sandy.

Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

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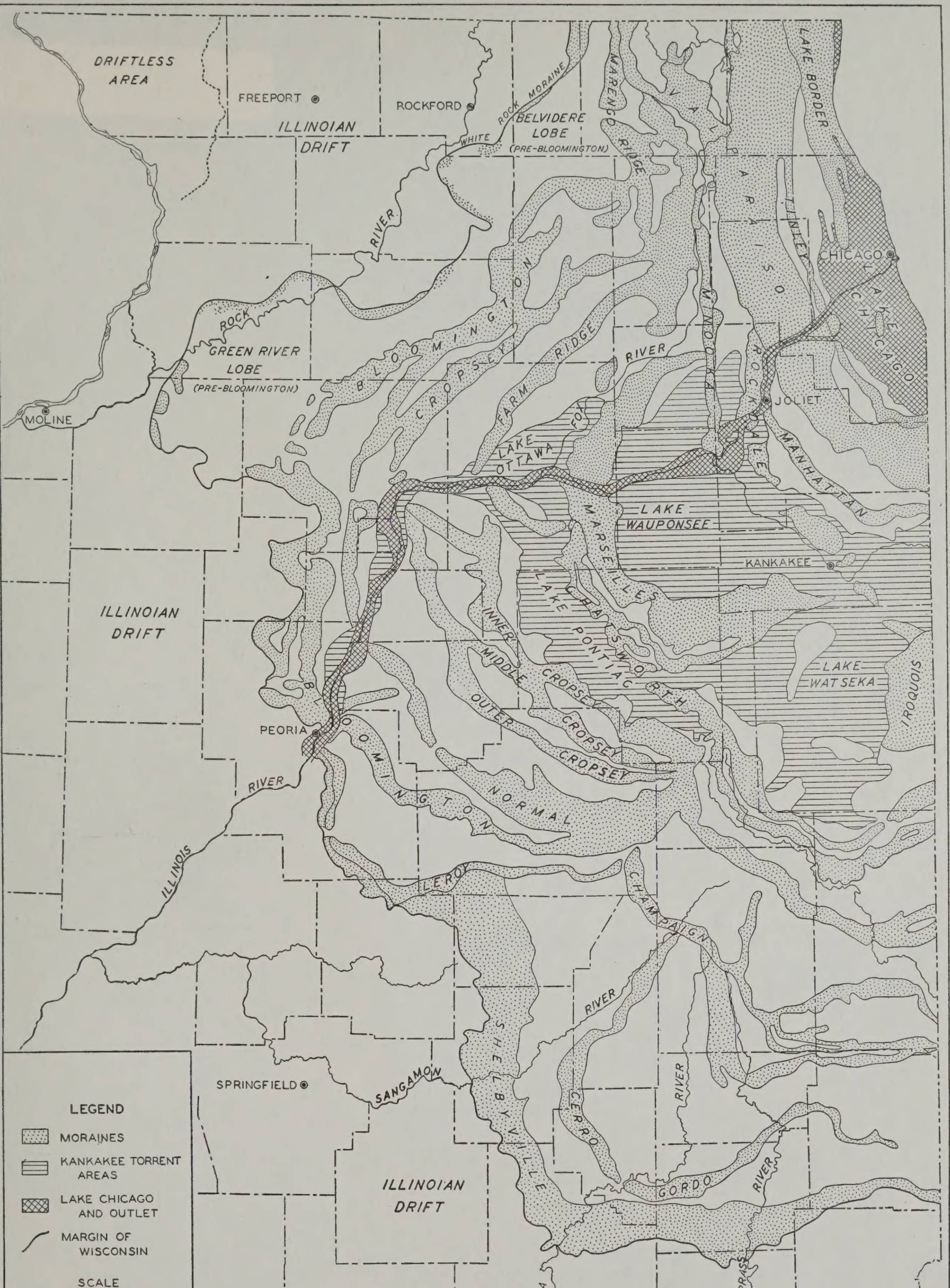

GLACIAL GEOLOGY IN NORTHEASTERN ILLINOIS
Compiled by George E. Ekblaw from data furnished by the Survey
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